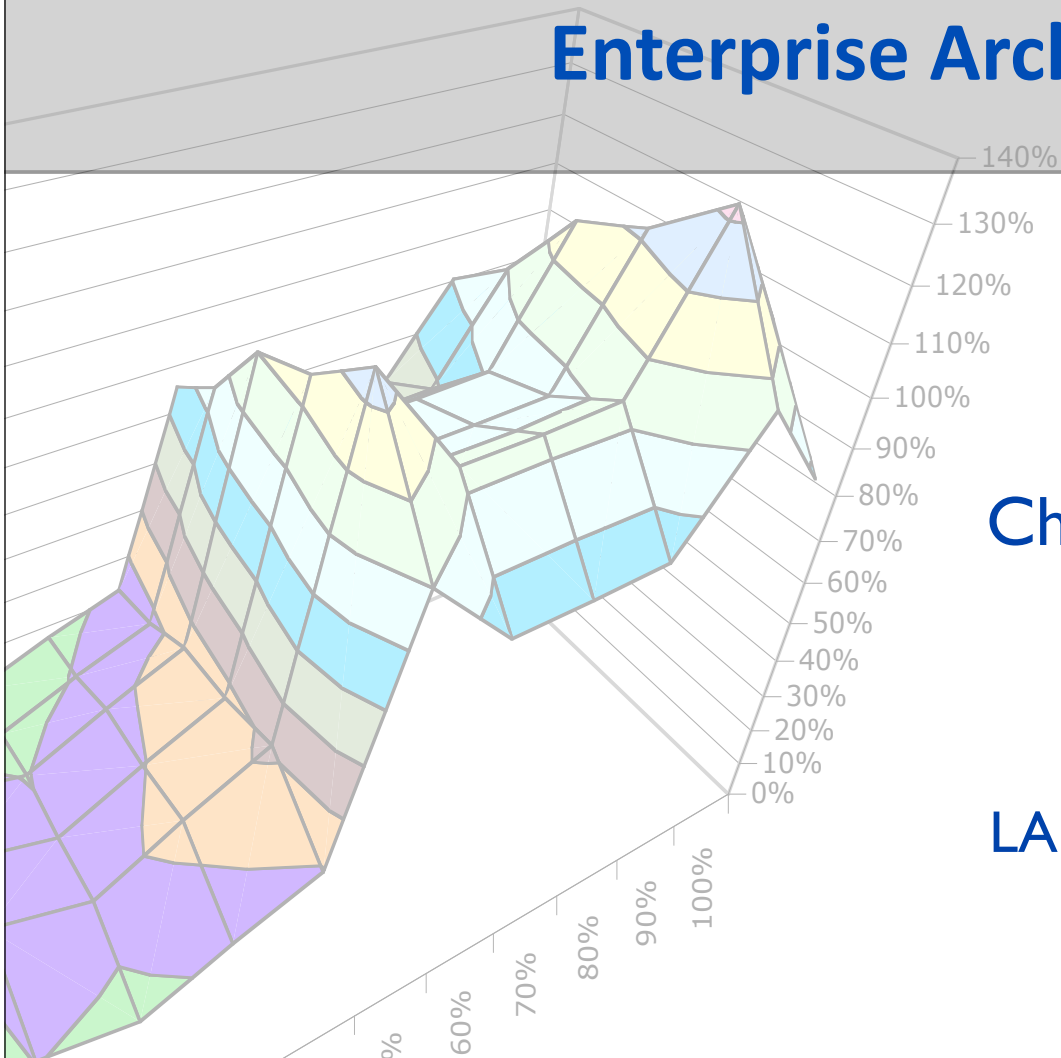




Understanding Enterprise Behavior Using a Hybrid Simulation of Enterprise Architecture

Dr. Chris Glazner, Presenter
LAI Web Knowledge Exchange Event
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Understanding Enterprise Dynamics Using Hybrid Simulation Modeling of Enterprise Architecture



Christopher Glazner, Ph.D.

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LAI Knowledge Exchange Event

Outline

- **Problem Motivation and Background**
- **Research Questions and Goals**
- **Existing Approaches**
- **Proposed Approach**
- **Application of approach: The TechSys Case Study**
- **Analysis of TechSys Simulation**
- **Contributions and Future work**

Imagine...



You are the CEO of a large, complex enterprise. The competitive environment is changing rapidly, and you need to adapt the structure and behavior of your enterprise to remain competitive.



- What do you change?
- What would the effects of the changes you make be across the enterprise?
- How can you evaluate different enterprise designs?
- How could you even begin to make tradeoffs?

In such a case as this, a trusted model of your enterprise's dynamics would be extremely useful!

Goals of this Research

Develop a simulation modeling approach that will be able to:

- **holistically analyze enterprise behavior, as it is influenced by the architecture across different perspectives and contexts of the enterprise;**
- **be useful to enterprise leaders and decision makers at a strategic level;**
- **allow users to gain insight into how apparently unrelated aspects of their enterprise can be interacting influence enterprise behavior;**
- **allow users to analyze trade-offs and conduct “what -if” analyses**

A comprehensive, predictive enterprise model is almost impossible!

There are significant problems with creating a comprehensive, predictive model of an enterprise:

- An enterprise is both extremely complicated and complex;
- An enterprise is full of people who make localized and not-strictly rational decisions (bottom up behavior) as well as centrally directed processes and procedures (top down behavior)
- An enterprise changes constantly;
- An enterprise has both “hard” (processes, metrics) and “soft” (culture, knowledge) aspects that must be understood.
- An enterprise can be understood using multiple theories and bodies of literature;
- *No single modeling approach can capture all of the essential dynamics of an enterprise’s design*



How can a modeler avoid “complexity catastrophe” and keep the model useful and relevant to senior leaders?

Existing Approaches to Enterprise Simulation

- **Discrete Event Models**

- Simulation of processes (Kalpic and Bernus, 2002; Sousa, et al., 1983)
- GPSS (Gordon, 1961); Petri Nets (Murata, 1989); Arena

- **System Dynamics**

- Simulation of causal dependancies, temporal relationships, allocation of resources
- Used to model strategy (Fowler, 2003), supply chains (Agerholfer and Angelides, 2000), innovation (Repenning, 1997), among others

- **Agent-based Modeling**

- Simulation of bottom up behaviors, the “micro-to-macro” phenomena , diffusion through a population, non-rational decision making (Sawyer, 2003)organizational design (Carely, 2002)

- **Hybrid Approaches that employ multiple methodologies**

- Advocated by (Mingers and Gill, 1997, Scholl, 2001, Sterman, 2000)
- Supply Chains (Schieritz and Größler, 2003)
- Production Planning (Rabelo, et al., 2005, Venkteswaran and Son, 2005)
- So far, these models have been limited in scope and application.

What is missing from hybrid simulation?

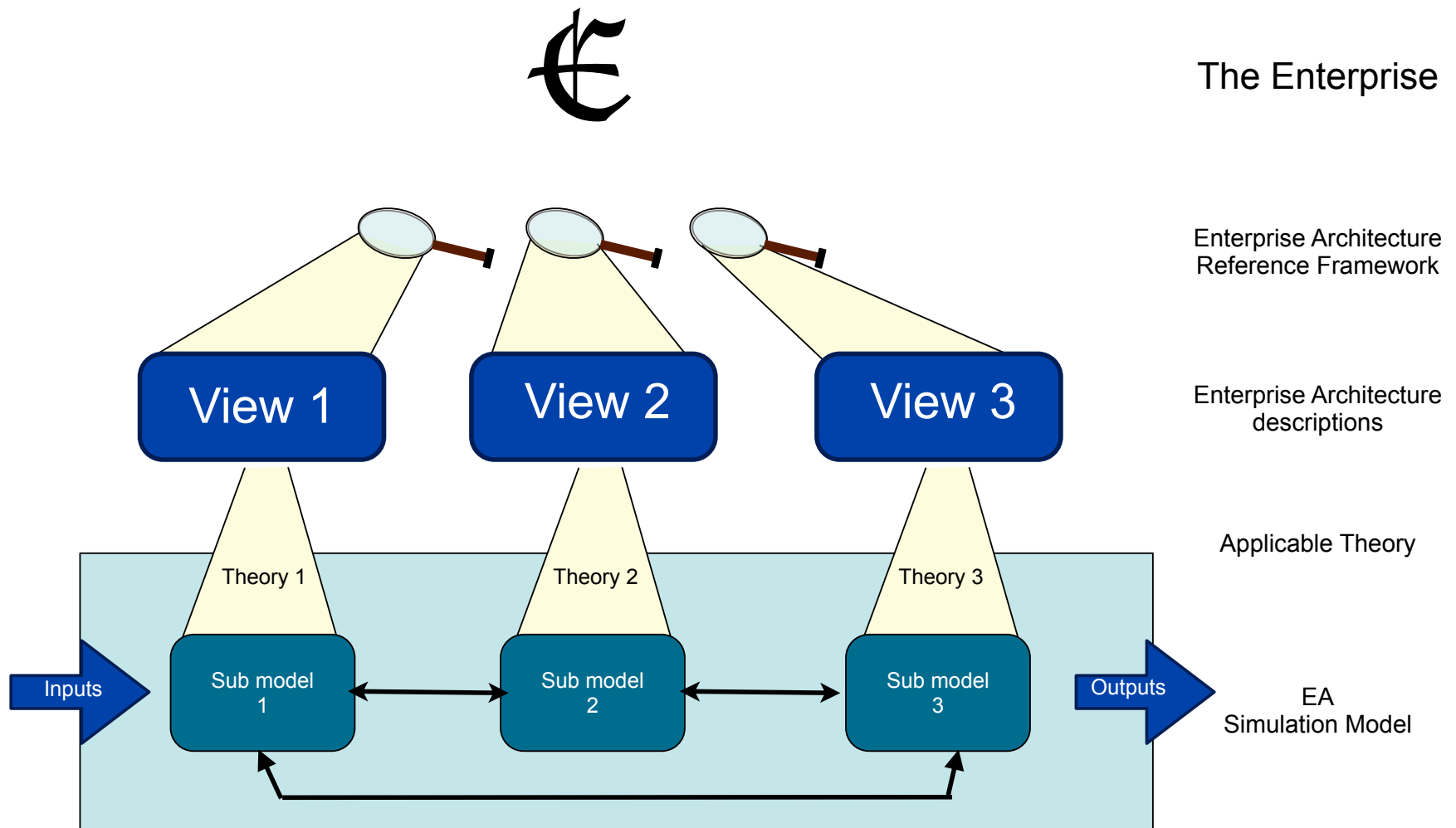
Assertion: Hybrid simulation efforts need a consistent, repeatable way to decompose the enterprise and structure the simulation

Idea:

Enterprise Architecture, and Enterprise Architecture Frameworks, can provide a basis for a near-decomposition* of the enterprise for purposes of simulation modeling

* In the sense of (Simon, 1958)

Using EA to compose simulation models



Case Study: An Application of Enterprise Architecture-Based Simulation Modeling

“TechSys”



- *~2 billion dollar multi-market “enterprise of enterprises” in the aerospace/defense sector*
- *Comprised of operating units in different market segments*
- *New strategy for growth: pursue new growth opportunities that require joint collaboration among operating units to deliver integrated systems*
- *Past two years: acquired new operating units and implemented new organization and processes architectures*

Key Questions for TechSys

- **Can TechSys achieve its growth goals given its current enterprise architecture with constrained resources available for growth?**
- **How does the enterprise perform as resource allocations are changed? Does the architecture favor a particular business model?**
- **What changes can be made to the enterprise architecture to improve opportunities for growth given resource constraints?**

Area of Focus for simulation model:

- **TechSys's pursuit and capture of new business**

Capturing TechSys's EA with LAI's EA Framework

Strategy

- Strategic planning and management cycles
- Desired market positioning

Organization

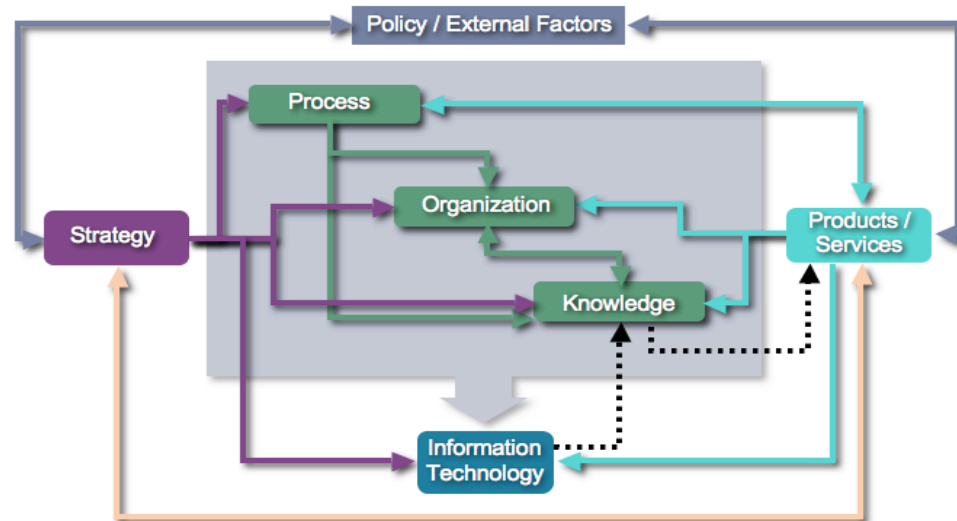
- OU incentives for proposal selection
- Connection and flow of information among positions in OUs

Process

- New business pursuit and capture process
- IRAD process

Knowledge

- Market knowledge
- Competencies
- Capabilities



Nightingale and Rhodes, 2009

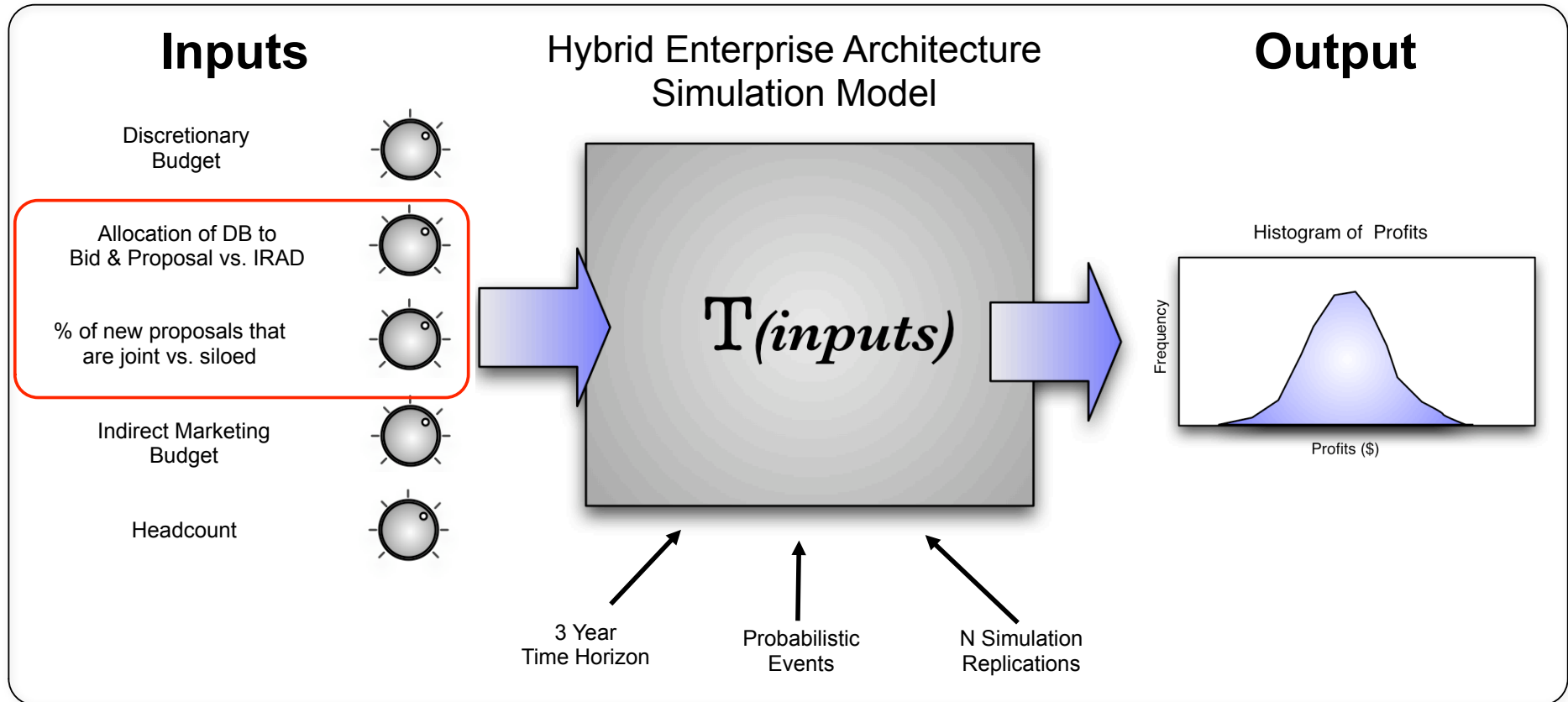
Information Technology

- Degree of IS integration among OUs

Policy/External Factors

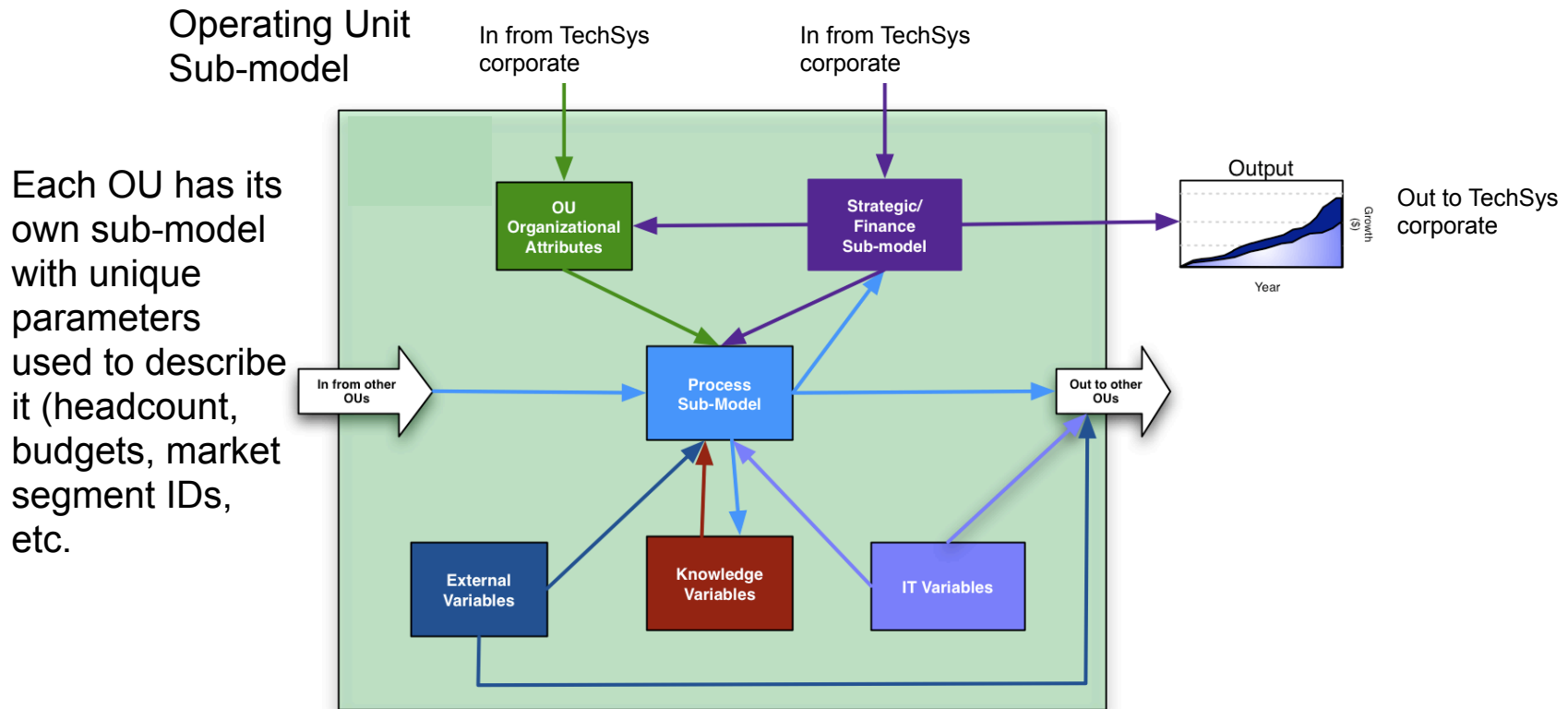
- FAR guidelines for collaboration

High-Level Conceptualization

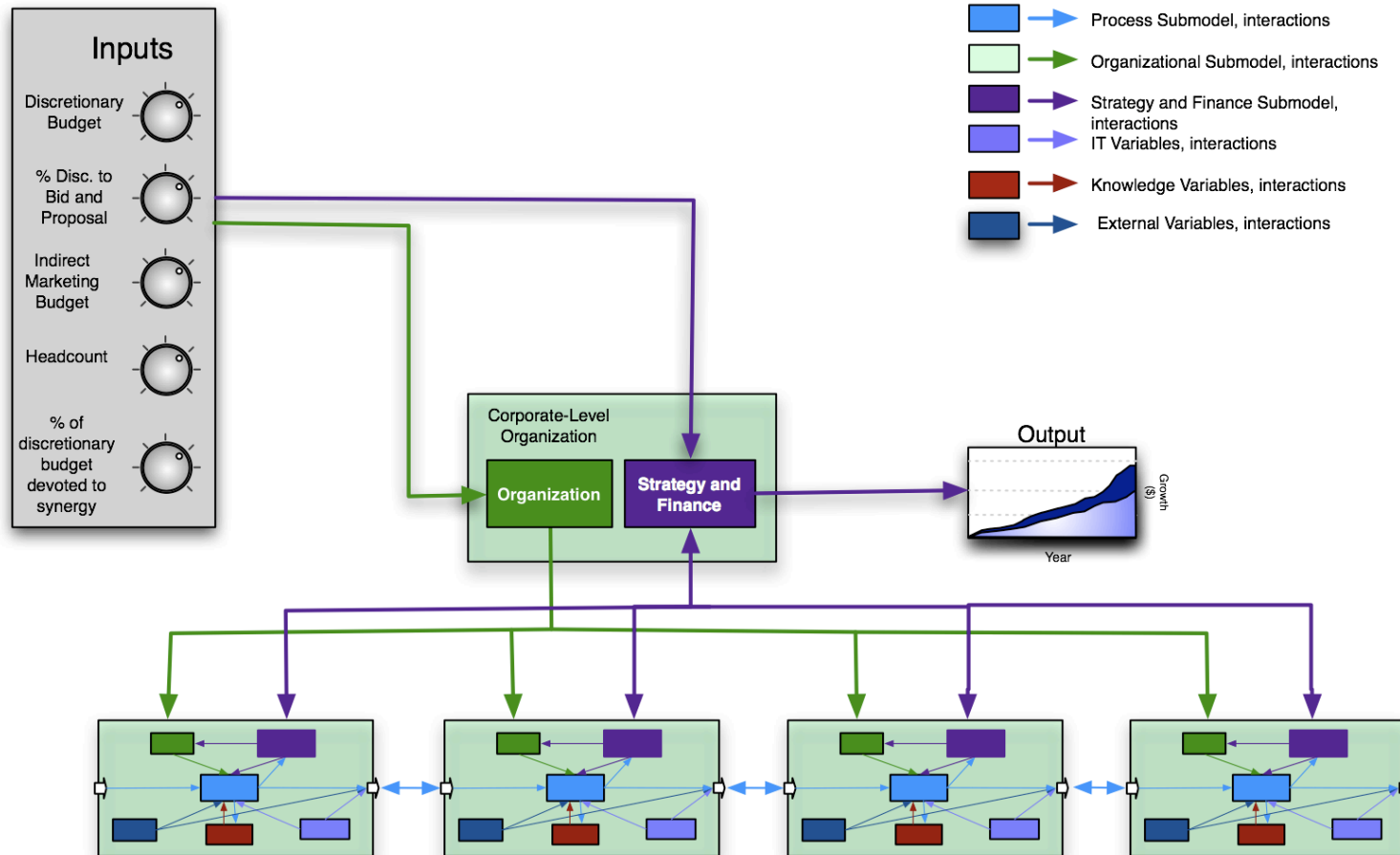


The model is run several hundred times in a Monte Carlo fashion for each combination of inputs to obtain a distribution for expected profits over a three year period

Operating Unit structure



Hybrid Structure Model

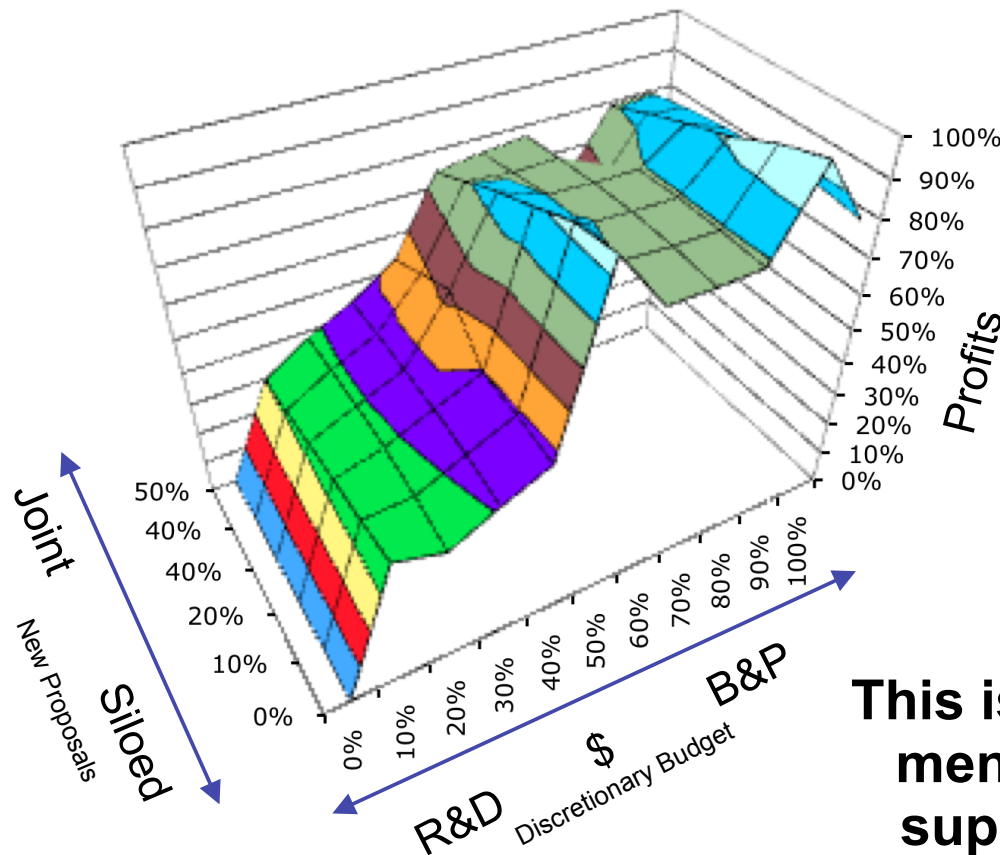


The Performance Landscape for the current Enterprise Architecture

Performance is best when :

1. the operating units do not pursue joint projects, and
2. the majority of discretionary funds is given to pursuing new proposals, rather than R&D

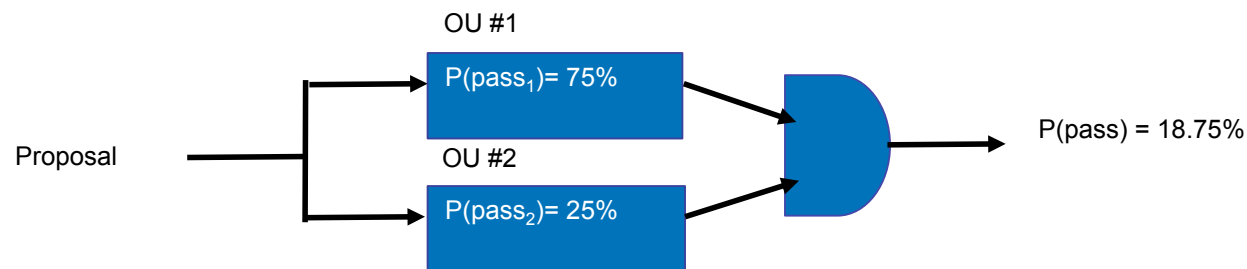
This is counter to the prevailing mental models and does not support TechSys's strategy!



Analysis of Enterprise Behavior

These surprising results in the model can be traced back to two major areas within the enterprise architecture:

1. Process structure (process view)
2. Organizational profit sharing incentives (organizational view)



The strong bias toward investing discretionary dollars towards pursuing bid and proposal activities can be attributed to:

1. Too short of a time horizon
2. Poor returns on R&D investment

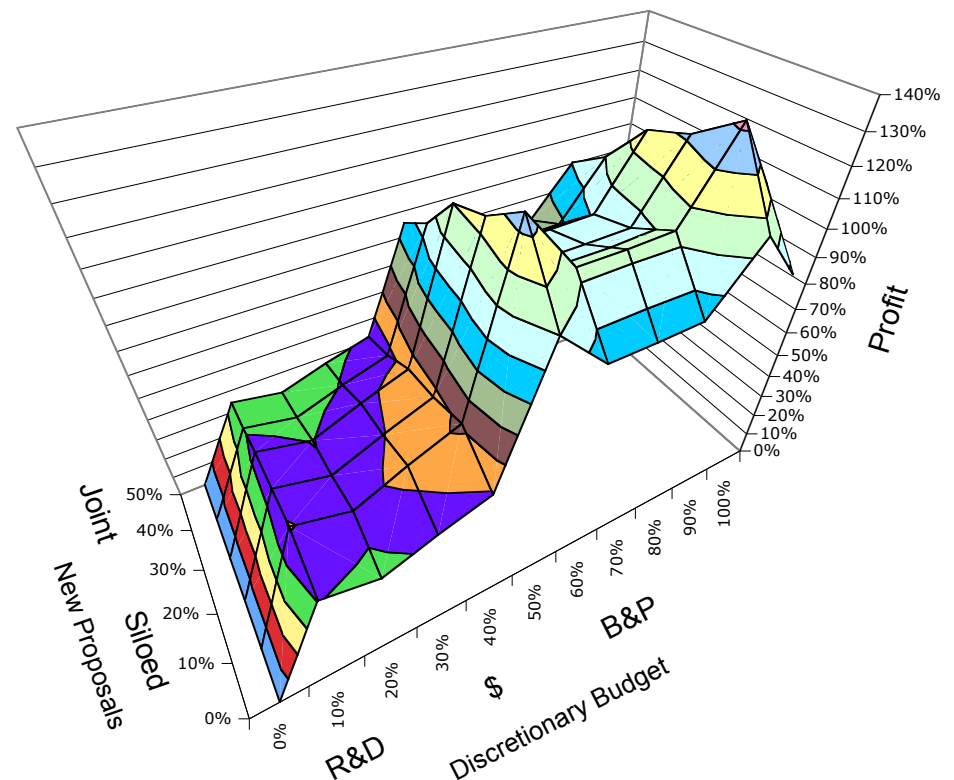
An Alternative Enterprise Architecture: “What If” Analysis

Can the potential performance of the enterprise be increased by modifications to the architecture?

Changes to the Enterprise Architecture:

- Modified OU incentives against joint proposals with a change in the way budgets are allocated
- Modified OU/TechSys proposal selection process to remove selection bias against joint proposals

Alternative Enterprise Architecture Performance Landscape



Unanticipated Benefits

- **Substantial missing component to TechSys's architecture: a knowledge architecture**
 - EA framework application highlighted the lack of planning with respect to knowledge, a key component of the new strategy
- **Uncovered several potential new metrics**
 - Modeling keeps you “honest”--must have numbers to make the model work
 - Missing areas for metrics: interfaces between process, knowledge, strategy
 - Example: “effectiveness” of IRADs

Summary of TechSys Model

The simulation was able to:

- Evaluate TechSys's architecture from a systems perspective
- Show that the current architecture would not support TechSys's strategy for future growth
- Suggest changes for an alternative architecture that was capable of meeting growth goals
- Indicate that TechSys needs to evaluate its discretionary budget allocation strategy
- Highlight unanticipated benefits owing to the process of model development

There is great potential for this model to be further developed.

Observations and Future Work

- This is the only known approach to simulate enterprise behavior using EA across multiple views, linking structure to behavior
- Even without taking the final step to create the simulation, the process of collecting the necessary data was extremely valuable.
- Area of significant future work: further develop EA Frameworks, especially with regard to inter-view interactions
- Need to more tightly integrate approach with an EA Framework
- Build “libraries” of common, customizable simulation modules

Questions?
